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**MINUTES
of the
FOURTH MEETING
of the
SCIENCE, TECHNOLOGY AND TELECOMMUNICATIONS COMMITTEE**

**October 17-18, 2013
Wooton Hall
2995 Knox Street
New Mexico State University
Las Cruces**

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The fourth meeting of the Science, Technology and Telecommunications Committee (STTC) for the 2013 interim was called to order by Representative Carl Trujillo, chair, on October 17 at 10:20 a.m. in Wooton Hall at New Mexico State University (NMSU).

Present

Rep. Carl Trujillo, Chair
Sen. Michael Padilla, Vice Chair
Rep. Kelly K. Fajardo
Rep. Jason C. Harper
Sen. Bill B. O'Neill
Rep. Debbie A. Rodella
Rep. Monica Youngblood

Advisory Members

Sen. Carlos R. Cisneros
Sen. Ron Griggs (10/17)
Sen. Richard C. Martinez
Rep. Bill McCamley
Rep. Jane E. Powdrell-Culbert

Absent

Sen. William F. Burt
Rep. Roberto "Bobby" J. Gonzales
Sen. Linda M. Lopez
Sen. John C. Ryan
Rep. James E. Smith
Rep. Luciano "Lucky" Varela

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Rep. Stephanie Garcia Richard
Sen. Timothy M. Keller
Sen. Steven P. Neville
Sen. William H. Payne
Rep. Nick L. Salazar
Rep. Don L. Tripp
Sen. Peter Wirth

(Attendance dates are noted for members not present for the entire meeting.)

Staff

Gordon Meeks, Legislative Council Service (LCS)
Ralph Vincent, LCS
Jennifer Dana, LCS

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Guests

The guest list is in the meeting file.

Handouts

Handouts and other written testimony are in the meeting file.

Thursday, October 17

Call to Order and Introductions

Representative Trujillo called the meeting to order and welcomed the committee members, staff, presenters and audience members to the meeting. At his request, committee members introduced themselves.

Welcome and Update on Issues of Interest to NMSU

Garrey Carruthers, Ph.D., president of NMSU, welcomed the committee to the NMSU campus and apprised the committee of NMSU's efforts at accelerating economic development locally and statewide. His presentation focused on the Arrowhead Center, Arrowhead Innovation Network (AIN) and NMSU's approach to meeting commercialization challenges.

Dr. Carruthers told the committee that it is the mission of the Arrowhead Center to help create economic opportunities for New Mexico residents, while assisting in serving the needs of New Mexico's diverse population. The mission is carried out through a variety of comprehensive programs, including education, research, extension education and public service. Arrowhead Center activities include:

- commercialization through innovation, including the creation of the Launch Proof of Concept Center;
- forming partnerships between university researchers, entrepreneurs, students, employees, facilities and key markets;
- engaging in projects in the realms of aerospace, agriculture, biotechnology, clean energy, information technology, water conservation and engineering; and
- leveraging partnerships to move innovative technologies from NMSU laboratories and development settings to market.

Dr. Carruthers explained that the AIN is a collaborative of regional players supporting the Launch Proof of Concept Center and is designed to: create and retain talent; invest in innovation and entrepreneurship; and strengthen the relationship between research and commercialization. The AIN works to fill in the gaps of the Launch Proof of Concept Center by creating a network to support it. The network is composed of individuals, organizations and corporations with business, technical and industry expertise and supports early stage investments; the AIN network is present in California, New Mexico and Texas.

Dr. Carruthers expressed that NMSU is rising to meet the challenges of commercialization in a number of ways by:

- targeting private sector business needs;
- encouraging and incentivizing faculty and student participation in innovation and entrepreneurship;

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- funding invention and innovation through seed grants, connections to angel investment groups and venture capitalists and attracting institutional and private investors to the NMSU Innovation Investment Fund; and
 - fostering partnerships between innovators and experts with business, technical, investment and industry expertise.

Members of the committee asked questions about and discussed:

- proof of concept funding;
- expansion of the angel investment credit;
- continuing to develop and expand the number of early college high schools in New Mexico;
- universities' infrastructure capital improvement plans for capital appropriations;
- interest in commercialization of intellectual property;
- current funding levels for the Higher Education Department; and
- partnerships between New Mexico universities and Los Alamos National Laboratory (LANL) and Sandia National Laboratories.

The committee discussed supporting legislation regarding State Investment Council investments.

Approval of Minutes of September 5-6, 2013 Meeting

A motion was made and adopted approving the minutes of the September 5-6, 2013 meeting.

Reduced Gravity Biometrics Laboratory

Ou Ma, professor in the College of Engineering in the Mechanical and Aerospace Engineering Department, NMSU, and Robert Wood, professor and academic head of the Department of Human Performance, Dance and Recreation, NMSU, greeted the committee in the Reduced Gravity and Biomechanics (RGB) Laboratory. The professors told the committee about the wide variety of research projects conducted in the engineering and human performance departments at NMSU and stressed the levels of interdepartmental cooperation and communication on research, in general, at the university. The professors showed pictures and videos of completed and ongoing research projects, and doctoral, graduate and undergraduate students demonstrated a number of research projects and devices.

Dr. Ma discussed the following research projects in his presentation to committee members:

- study of human performance and factors in zero- or reduced-gravity environments;
- technology to assist mobility rehabilitation;
- prediction and prevention of fall risk in older adults;
- mathematical modeling and simulation of human bodies;
- bio-inspired unmanned aerial vehicle design, guidance and control;
- unmanned aircraft systems autopilot system integration and testing;

- space robotics control for on-orbit servicing; and
- impact-contact dynamics modeling and simulation.

Dr. Wood talked about the following research efforts in his presentation to the committee:

- biomechanical analysis of gait and fall risk in seniors;
- biomechanical implications of obesity for injury in youth;
- prevention of childhood obesity and diabetes;
- literacy through movement;
- motor learning in sports and rehabilitation; and
- head injuries in college and high school athletes.

Members of the committee asked questions about and discussed:

- military support and use of the RGB Laboratory technology and facilities;
- use of the RGB Laboratory technology for rehabilitation;
- National Institutes of Health certification for human testing; and
- patenting unique technologies developed in university settings.

A motion was made and adopted to support the NMSU request to the Higher Education Department for approval of a Ph.D. degree program.

Spaceport America Status Report

Christine Anderson, executive director of the Spaceport Authority, updated the committee on the progress of Spaceport America. Phase one of the implementation of the spaceport is complete. Ms. Anderson explained that Spaceport America is set up to be a self-contained city, featuring a fuel storage depot, water storage and booster station, wastewater treatment plant, communications system and weather station. Additionally, she told the committee that UP Aerospace, SpaceX and Virgin Galactic are confirmed Spaceport America tenants and have flights from New Mexico scheduled in 2014 and 2015. Finally, Ms. Anderson reminded committee members that informed consent legislation was signed during the last legislative session, which expanded protections to keep New Mexico competitive in the commercial space industry.

Ms. Anderson told the committee that phase two of the implementation of Spaceport America is under way. The business model for the spaceport is based on two major lines of business, both essential for long-term success: 1) vertical and horizontal space launches; and 2) tourism. The spaceport is in the process of obtaining Federal Aviation Administration spaceport license recertification, enumerating operational policies and procedures for all spaceport facilities and completing the southern road. She said that the design of the visitor experience has been completed and construction of the visitor center is under way.

Ms. Anderson explained that Spaceport Authority marketing and outreach activities are taking place in earnest. In the past 12 months, the Spaceport Authority has participated in more than 50 media interviews and more than 20 media tours and has engaged in media visits with

representatives from 18 countries. Media exposure and spaceport expansion have positively affected New Mexico's economy, creating more than 1,300 jobs for New Mexicans since its inception. An additional 1,003 jobs are projected for fiscal year (FY) 2016, and 1,624 jobs are projected for FY 2018.

Members of the committee asked questions about and discussed:

- the schedule for the southern road pavement and infrastructure;
- office locations of Spaceport America tenants;
- frequency of launches from the spaceport;
- new industry and economic opportunities presented by an influx of visitors to Spaceport America; and
- other U.S. spaceports.

Renewable Energy Infrastructure Opportunities

Jim Witcher, geologist and consultant at Witcher and Associates, outlined technology and infrastructure opportunities for the use of geothermal energy in New Mexico. Mr. Witcher explained that there are conductive and convective geothermal systems in New Mexico. Conductive systems are characterized by their very deep and large reservoirs; greater salinity; suitability for large-scale power and desalination; applicability for brine disposal; stratigraphic reservoir; and higher cost and risk. Convective systems are characterized by their shallow and smaller reservoirs; suitability for direct-use and small-scale power; brackish water; structural reservoir; and lower cost and risk.

Mr. Witcher explained that geothermal energy systems have the potential to be used for electrical power and direct-use and ground-coupled heat pumps. These systems also have the potential to be used for desalination, copper and gold mining, oil and gas production, biofuel generation, greenhouse heating and aquaculture. In addition to the scope of use for geothermal energy systems, the capacity for geothermal energy far exceeds the capacity for other types of renewable energy resources in New Mexico, making it an especially enticing source of energy.

Mr. Witcher concluded his presentation by urging that the definition of "geothermal energy" in New Mexico be revisited. He advocated for sustained support for the New Mexico component of the national geothermal database at the New Mexico Bureau of Geology & Mineral Resources at the New Mexico Institute of Mining and Technology (New Mexico Tech) and for sustained university-based outreach for direct-use geothermal economic development.

Andrew Rosenthal, director of the Southwest Technology Development Institute (SWTDI) in the College of Engineering at NMSU, talked to the committee about the implications of photovoltaics (PV) and solar energy for New Mexico. Mr. Rosenthal explained that the SWTDI works to provide support for public agencies and private industries that choose to utilize PV and solar energy generation systems. He also discussed partnerships with the Navajo Tribal Utility Authority (NTUA) and Lennox Industries to illustrate the work of the SWTDI. Efforts of the SWTDI and NTUA helped to determine that PV is an effective solution

to power remote homes and facilitated the purchase of more than 400 stand-alone PV systems from Sacred Power by the NTUA. The SWTDI's collaboration with Lennox Industries resulted in the Lennox SunSource solar-assisted heat pump becoming a catalog item for sale throughout North America. Additionally, Mr. Rosenthal highlighted that the SWTDI was awarded a contract from the federal Department of Energy (DOE) to create, lead and consolidate all of the DOE's dispersed efforts in solar technology-related codes and standards. The SWTDI branded the contract with the name Solar America Board for Codes and Standard (SolarABCs). Originally awarded as a five-year, \$4.2 million program, SolarABCs later received an extension to become a six-year, \$5 million program.

Patricia Sullivan, assistant dean of the College of Engineering at NMSU, told the committee about the New Mexico Green Grid Project. The project is a state initiative that aims to set up a delivery system for an innovative approach to electric generation, distribution, storage and management. Generation methods include PV and solar systems. NMSU engages students in the creation of this new technology by including it as course work in power engineering classes. Additionally, faculty, businesses, farmers and ranchers are working to implement elements of the project through extension programs around the country. Commercialization and technology transfer is being facilitated through the New Mexico Small Business Assistance Program and partnerships with LANL and Sandia National Laboratories.

Committee members' questions followed, and the following points were raised:

- the connection of the SWTDI with the Mesa del Sol project at Public Service Company of New Mexico;
- use of geothermal power in desalination;
- potential deterioration of geothermal resources in New Mexico;
- amount of power generated by geothermal energy; and
- comparison of geothermal power and greenhouse costs.

Alamogordo Desalination

Matt McNeile, city manager of Alamogordo, gave a presentation to the committee on the history and update of the Alamogordo Regional Water Supply Desalination Project. Mr. McNeile told the committee that Alamogordo differs from most municipalities in New Mexico because the majority of its potable water supply comes from surface water. The city collects surface water from the Sacramento Mountains and Bonito Lake and collects ground water from the La Luz well field. Water is not collected from these sources without difficulty, however, and historically, it has been difficult to produce enough potable water to meet the needs of the growing city.

Mr. McNeile told the committee that the city began carefully assessing the existing water uses and looking for new sources of water in the mid-to-late 1990s. During this study and analysis period, the city adopted aggressive ordinances limiting water use and instituted water-use surcharges. These efforts helped to reduce per capita water usage in the 1999-2001 period to approximately 140 gallons per capita per day (gpcd), a 54% decrease from 260 gpcd in the early

1990s. Mr. McNeile explained that while progress was made with conservation, the city was aware that conservation alone could not provide an adequate water supply for both present and future needs.

The city considered many options for new water supplies and concluded that the only way to get a large drought-resistant appropriation without decades of applications for small appropriations and/or transfers was to pursue a well field that would divert brackish ground water in conjunction with a desalination facility. The city commissioned a study of possible brackish water sources. Ultimately, the Snake Tank well field was selected because of the:

- availability of unappropriated brackish ground water;
- large quantity of ground water in storage;
- relatively even and acceptable brackish water quality;
- opportunity to capitalize on the gravity flow of water to deliver water to the treatment plant; and
- Snake Tank well fields location outside the Tularosa Basin administrative criteria area.

Mr. McNeile told the committee that a location has been selected for the desalination facility. The facility will be constructed in stages to phase in capital costs. A final build-out capacity is estimated to be 2.8 million gallons per day of potable water. The plant is intended to be a "peaking" facility, or drought reserve, to activate when surface flows and existing ground water are insufficient to meet the city's growing needs. Mr. McNeile told the committee that the desalination project will cost an estimated \$54 million. He stressed that the project is not only important to the city, but also to the region and the continued viability of Holloman Air Force Base. The city's desalination project is expected to work in conjunction with the Tularosa Basin National Desalination Research Facility in equipping the city's plant and using next-generation products and advances in desalination technology. The desalination facility also has the potential to be used by other regional entities in need of commercial, industrial or municipal water supplies. Mr. McNeile concluded his presentation by stating that the most pressing issues Alamogordo faces in moving forward to make the desalination facility a reality is the completion of the Department of Environment's permitting process and funding assistance to complete the construction of the project.

Dr. Sam Fernald, director of the New Mexico Water Resources Research Institute (NM WRRI), gave a presentation to the committee on the mission of the NM WRRI, NM WRRI's research on desalination and future NM WRRI research projects and applications. Dr. Fernald explained that it is the mission of NM WRRI to support water research at NMSU, the University of New Mexico and New Mexico Tech. The institute serves as a model for institutes nationwide. Regarding NM WRRI's desalination research, Dr. Fernald told the committee that the five key elements of a desalination system are intakes, pretreatment, desalination, post-treatment and concentrate management. The energy for desalination can come from a variety of sources such as thermal, electrical, chemical and physico-chemical.

Dr. Fernald briefly discussed past NM WRRI research. The projects he expounded upon were capacitive deionization, high recovery reverse osmosis, pressure retarded osmosis and reverse osmosis. Ongoing research projects that Dr. Fernald addressed included PV reverse osmosis, ion exchange for turning concentrate water into marketable products, radial deionization and agricultural use of concentrate. Ongoing and future research may have applications for gravity-based water changes, updated ground water assessments and desalination technologies.

Committee members' questions followed, and the following points were raised:

- funding sources covering the cost of the Alamogordo desalination project;
- unintended consequences of the Alamogordo desalination project;
- unreliability of Bonito Lake and the pipeline;
- disposal of removed solids (wastes); and
- implications for New Mexico of NM WRRI policy, research and applications.

Experimental Program to Stimulate Competitive Research

Mary Jo Daniel, associate director of the New Mexico Experimental Program to Stimulate Competitive Research (NM EPSCoR), told the committee that NM EPSCoR is a partner with the National Science Foundation to improve research and development competitiveness through the state's academic science and technology infrastructure. NM EPSCoR is a university-oriented program, with the goal of identifying, developing and utilizing academic resources that will lead to increased research and development competitiveness.

Ms. Daniel told the committee that partnerships among universities, community colleges, national laboratories and private industries not only improve research infrastructure, but also strengthen New Mexico's science, technology, engineering and math (STEM) work force. Since 2001, NM EPSCoR has bolstered New Mexico's academic research capability in:

- nanoscience;
- biomedical engineering;
- ecological research;
- hydrology and aquatic chemistry;
- climate science and modeling; and
- socioeconomics.

Ms. Daniel told the committee that NM EPSCoR's new project, Energize New Mexico, focuses on realizing New Mexico's potential for sustainable energy development. The vision of the project is to help New Mexico lead the nation in:

- harnessing and promoting sustainable energy resources;
- cultivating a well-qualified STEM work force; and
- developing a sustainable culture of entrepreneurship and innovation.

Infrastructure and activities of Energize New Mexico are designed to support shared-use equipment, engage new faculty and support the STEM pipeline. Research findings will be

communicated broadly through new partnerships with New Mexico's museum network, a citizen-centric-designed web portal and vibrant experiential programs targeting K-12 students.

Energize New Mexico's funding is allocated for research (65%), education and outreach (22%), cyber infrastructure (8%) and administration (5%). Research component funding is allocated for:

- bioalgal energy (28%);
- solar power (16%);
- geothermal energy (12%);
- osmotic power (12%);
- social and natural science nexus (12%);
- uranium transport and site remediation (12%); and
- seed awards (8%).

Peter J. Lammers, research professor and technical director of the Algal Bioenergy Program at NMSU, discussed the NM EPSCoR BioAlgae Energy Program. Mr. Lammers explained that the program is attempting to answer the following scientific questions.

- Can inexpensive, scalable, close bioreactor designs maximize biomass productivities with heat-tolerant algae in summer and cold-tolerant strains in winter with minimal water consumption and cultivation costs while achieving a net positive energy balance?
- What species or community characteristics and cultivation conditions best promote stable, reproducible, large-scale production of algal biomass and also harmonize with: 1) design specifications for algal cultivation; 2) extraction and conversion processes for high-, mid- and low-value products; and 3) quality-assurance and quality-control specifications for fuels and co-products?
- Can wastewater sources safely offset nutrient requirements at large scales, and how do associated scale-up logistics, reactor design and operation affect output water quality to meet process recycling and discharge requirements?

Mr. Lammers told the committee that the BioAlgae Energy Program has several commercialization targets: energy-positive municipal wastewater treatment; energy-positive dairy and cheese manufacturing wastewater treatment; and renewable hydrocarbon fuel production using water and carbon dioxide from petroleum extraction.

Members of the committee asked questions about and discussed:

- the BioAlgae Energy Program's interaction with Sapphire Energy;
- the susceptibility of algae to disease and to population crashes; and
- the BioAlgae Energy Program's level of collaboration with LANL and Sandia National Laboratories.

The committee recessed at 5:30 p.m.

Friday, October 18

Telecommunications Regulation

Sandra Skogen, Office of the General Counsel and associate general counsel of the Public Regulation Commission (PRC), and Mike Ripperger, Chief, Telecommunications Bureau, PRC, told the committee about key statutes to New Mexico telecommunications legislation and explained the regulation of incumbent local exchange carriers (ILECs) in New Mexico. Ms. Skogen and Mr. Ripperger discussed:

- the New Mexico Telecommunications Act, enacted in 1985;
- the Rural Telecommunications Act of New Mexico (RTA), enacted in 1999;
- the alternative form of regulation legislation, enacted in 2000;
- mid-size carrier legislation, enacted in 2004;
- 2005 amendments to the RTA; and
- 2013 amendments to the RTA.

Ms. Skogen and Mr. Ripperger provided committee members with a chart detailing what they see as disparate regulation of ILECs in New Mexico. The chart includes carrier types, rate regulation, tariff changes, service quality, investment, consumer protection and enforcement.

Members of the committee asked questions about and discussed:

- the history of legislative proposals to reform telecommunications regulation;
- the responsibility of telecommunications carriers to provide services;
- the balancing of shareholder and consumer interests;
- notices for residential rate increases for services;
- penetration levels of competitive local exchange carriers;
- the effectiveness of the RTA;
- the relevancy of the number of lines served by ILECs to legislation;
- clarification of PRC rulemaking authority; and
- relaxing regulations.

Senator Padilla presented committee members with a discussion draft of a senate bill that would further amend the RTA. A motion was made, seconded and unanimously approved to suspend a vote to endorse the bill until the next interim committee meeting on November 18-19, 2013.

Agriculture Technology Advances/Technology Improvements in Agricultural Water Use

Dr. Fernald spoke to the committee about the Rio Grande Basin Initiative (RGBI). Dr. Fernald explained that the RGBI is a sampling of irrigation efficiency research in New Mexico and Texas from 2003 to 2012 and has nine focus areas: 1) irrigation district studies; 2) irrigation education and training; 3) institutional incentives for efficient water use; 4) on-farm irrigation system management; 5) urban water conservation; 6) environment, ecology and water quality protection; 7) saline and wastewater management and reuse; 8) basinwide hydrology, salinity modeling and technology; and 9) communications and accountability. To date, five of the focus

areas have been analyzed. Dr. Fernald concluded his presentation by summarizing the RGBI's findings thus far.

- Existing efficiency programs include technology, policy and collaboration.
- There is room for expanded efficiency programs.
- Efficiency varies by location in the Rio Grande Basin from upstream to downstream.
- Research will pave the way for implementation of programs.

Dr. Phil King, professor and associate department head of the Department of Civil Engineering at NMSU, talked to the committee about technical advances in water-use efficiency with respect to application efficiency. Dr. King explained that application efficiency refers to the efficiency of the irrigation application systems; it is the ratio of irrigation water consumed by the crop to the water applied to the crop from the farm ditch or pipeline. Dr. King further explained that there are two classes of irrigation systems, and both systems benefit from conservation technology research. These systems are described as follows:

- surface irrigation systems apply water to the soil surface at the head of the field and allow the flow to advance to the tail; and
- pressurized irrigation systems rely on pipes to distribute water throughout the field and are classified as either sprinkler or drip systems.

Dr. King also discussed the differences and benefits of "dry water" conservation and "wet water" conservation.

Members of the committee asked questions about and discussed:

- the uncertainty of water rights adjudications;
- regional water planning funding;
- the statewide "water budget"; and
- water marketing.

Adjournment

The meeting adjourned at 12:15 p.m.